

THE CLAIMS

What is claimed is:

1. An injection device comprising: a housing, a nozzle assembly removably associated with the housing and defining a fluid chamber, a plunger; a trigger assembly, an energy generating source operatively associated with the trigger assembly so that movement of the trigger assembly activates the energy source to move the plunger in a first direction and expel a fluid from the fluid chamber, and a fixed injection-assisting probe at a distal end of the injection device, said injection-assisting probe comprising:

a body fixed to a distal end of the nozzle assembly; and
a discharge channel extending through the probe body, in fluid communication at a first end with the fluid chamber, and terminating at a second end in an orifice through which the fluid is expelled.

2. The injection device of claim 1, wherein the discharge channel has a length and the discharge channel length to orifice diameter is greater than 6/1.

3. The injection device of claim 2 wherein the discharge channel length to orifice diameter is at least 9/1.

4. The injection device of claim 1, wherein the orifice diameter is between 0.004 to 0.012 inches.

5. The injection device of claim 1, wherein a discharge channel length is at least 0.024 inches

6. The injection device of claim 1, wherein the discharge channel is provided in the form of a metal tube which is associated with the probe body.

7. The injection device of claim 6, wherein the metal tube is made of stainless steel.

8. The injection device of claim 6 wherein the probe body includes a flexible membrane and the metal tube passes through the membrane.

9. The injection device of claim 8 wherein the membrane is sufficiently recessed within the probe body that the metal tube does not protrude out of the body until fluid is being expelled from the fluid chamber.

10. The injection device of claim 1, wherein the nozzle assembly comprises two sections.

11. The injection device of claim 10, wherein the two nozzle assembly sections are joined by ultrasonic bonding means, screwing means, friction fitting means, adhesive bonding means, or snapping attaching means.

12. The injection device of claim 11 wherein one section of the nozzle assembly includes the probe and the other includes a metal tube which is joined to the probe body by a snapping attachment means comprising at least one protrusion on a wall of the metal tube and at least one corresponding recess on a wall of the probe body, with the metal tube including the discharge channel.

13. The injection device of claim 12 wherein the metal tube receives the probe body therein.

14. The injection device of claim 12 wherein the probe body surrounds the metal tube and includes an aperture therein for passage of the discharge channel therethrough.

15. The injection device of claim 11 wherein the probe body includes an aperture and the discharge channel is a metal tube which is bonded to the aperture to provide the orifice through which the fluid is expelled.

16. An injection device comprising: a housing, a plunger assembly, a trigger assembly, an energy generating source operatively associated with the trigger assembly so that movement of the trigger assembly activates the energy source to move the plunger in a first direction, and a nozzle assembly comprising:

a fluid chamber for holding fluid; and

a nozzle discharge channel in fluid communication with an end of the fluid chamber and having an orifice through which fluid is expelled when the plunger is moved in the first direction, wherein the discharge channel has a length to orifice diameter ratio of greater than 6/1.

17. The injection device of claim 16, wherein the orifice diameter is between 0.004 to 0.012 inches and the discharge channel has a length of at least 0.024 inches.

18. The injection device of claim 16 wherein the discharge channel has a length to orifice diameter ratio is between 9/1 and 20/1.